

Explosives

Explosives are the chemical substances that suddenly vaporized and expands on detonation or rubbing under pressure and so undergoes huge explosion with the evolution of gaseous product and energy.

Shortly, a material which when subjected to sudden shock or rub releases energy in an extremely brief period of time in the form of an explosion is called explosive. These explosions are fast and are associated with oxidation reaction releasing heat and large volume of gases.

Since explosive reactions are exothermic, the products get heated up to very high temperature and exerts high pressure on the surroundings which can be used for constructive as well as destructive purposes.

The earliest explosive, said to have been invented by Chinese as gun powder (Black powder) a mixture of KNO_3 , sand and charcoal. The British were the first user in the war in 1346 AD.

A popular explosive GTN (Glyceryl trinitrate) was first prepared by an Italian chemist Sobrero. He mixed nitric acid with glycerine and the resulting explosion nearly killed him. But this explosive GTN was handled carefully by a Swedish chemist Alfred Nobel who demonstrated that when GTN is absorbed in kieselguhr (a porous clay extracted from the bones of sea animals) it could be handled, transported safely. This adsorbent kieselguhr is referred to as dynamite.

To ~~ob~~ Explosives can be used for constructive as well as destructive purposes. In industries, explosives are employed

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for blasting ores of iron and other metals, breaking down coal, mining salts, blasting holes in the mountains for the construction of tunnels, excavating earth for the constructions of dams, dislodging rocks. Plastic explosives attached to a piece of metal is used to shape the metal to required shapes that are not achievable by other methods which is the recent method for shaping of metallic articles, explosives are also used in quarrying stones (ie breaking heavy stones. (खानीवार हड्डा निकालन)). The explosives now a days used in aerial bombs, rockets, grenades etc. as war purposes.

Characteristics of Explosive:

1. The rate of decomposition of explosive should be very fast to produce a large volume of gaseous product & energy.
2. It should be cheap and stable under normal conditions. Explosive must not be volatile, hygroscopic and should be chemically stable i.e. it should not react with the container.
3. It must have at least one chemical bond that can be easily broken i.e. molecule should have low energy of dissociation e.g. N-N, N-O, N-Cl etc. the difference of electronegativity in them may be zero or very small, so that they can explode easily.

Types of Explosives

There are mainly 3 types of explosives.

1. Primary or Initiating Explosives
2. Low explosives or Propellants
3. High explosives.

1] Primary or Initiating Explosives:

These are the explosive substances which undergoes mild explosion. They consists mainly a single compound used as rubbing agent or detonator.

These primary explosives are highly sensitive explosives which explode on a slight shock or small fire, so that they should be handled with the utmost (maximum) care. They are mainly used in small quantities in shell or cartridge to start the explosion of main explosive where main explosives are less sensitive. They are not used as main explosive itself but used as detonators (that sets off an explosion).

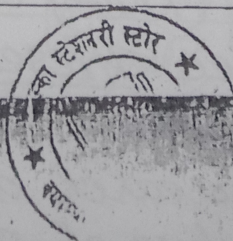
Examples of Primary explosives are: Lead azide (PbN_6), Lead Stiphate ($C_6H_3N_8O_8 \cdot Pb$), Mercury fulminate [$Hg(CNO)_2$] etc.

2] Low Explosives or Propellants:

These are the substances that generally does not explode but burns suddenly and rapidly with the formation of gases that creates a high pressure so that objects are launched too fast. These are blowing up agents or propellants.

The chemical reaction taking place in these explosives are comparatively slow and their burning proceeds from the surface inwards. e.g.

✓ Gun Powder (Black Powder): which is a mixture of 75% KNO_3 , 15% Charcoal & 10% Sulphur. It does not explode but burns very rapidly forming a high pressure gas which launches objects extremely fast. These are also used in fireworks (small exploding devices giving of a colourful display of light)



2) Smokeless powder (nitrocellulose) : It is prepared by treating cellulose with nitric acid and sulphuric acid. It is called smokeless powder because it produces CO_2 , CO , N_2 , H_2O vapour and almost no smoke.

3] High Explosives:

These are the most marvellous (stunning) group of explosives. They are very unique with great power but less sensitive than others. These are the perfect explosives for blasting and excavating. These are also used in many military weapons including missiles, bombs etc. However they are quite stable and quite insensitive to fire and mechanical shocks. A small amount of primary explosive is placed in contact with a high explosive. Primary explosive starts the rapid chemical reaction in the body of high explosive. High explosives are chain explosives. The explosion power of which is often increased by the addition of another substance.

1. Nitroglycerine (NG) : OR Glycerol trinitrate (GTN) :

It was the first high explosive. It is most powerful and sensitive of all the explosives. It is prepared by adding glycerol with the mixture of $\text{Conc } \text{H}_2\text{SO}_4$, 60%, $\text{Conc } \text{HNO}_3$, 40% at 10°C temperature.

2. Dynamite : It is obtained by plasticizing a mixture of trinitroglycerine (TNG) and dinitroglycerine with the porous clay called kieselguhr which is extracted from the bones of sea animals.

3. RDX : It is research and development explosive which is the mixture of nitric acid (HNO_3) and

hexamethylene tetramine. It is more sensitive but less toxic than other like TNT. It is used in the military purpose as well as an industrial explosive, during world war II.

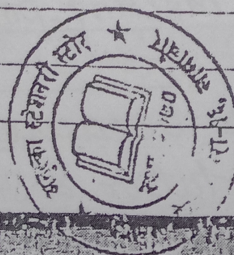
4. Gun Cotton: It is a high military explosive also called Cordite. It is made by gun cotton (cellulose nitrate) (65 parts), nitroglycerine (30 parts) and petroleum jelly or vaseline (5 parts) in acetone. It is plasticized by nitrocellulose.

5. PETN: (Pentaerythritol tetranitrate): It is an extremely powerful, sensitive and standard military explosive. It is so highly sensitive that it can be detonated even by the impact of a rifle bullet.

6. TNT: (Trinitrotoluene): It is high explosive made by nitration of toluene. It is most widely used in shell-firing and underwater explosion. It can be transported easily loading in container. A mixture of PETN & TNT in equal proportion is called pentolite.

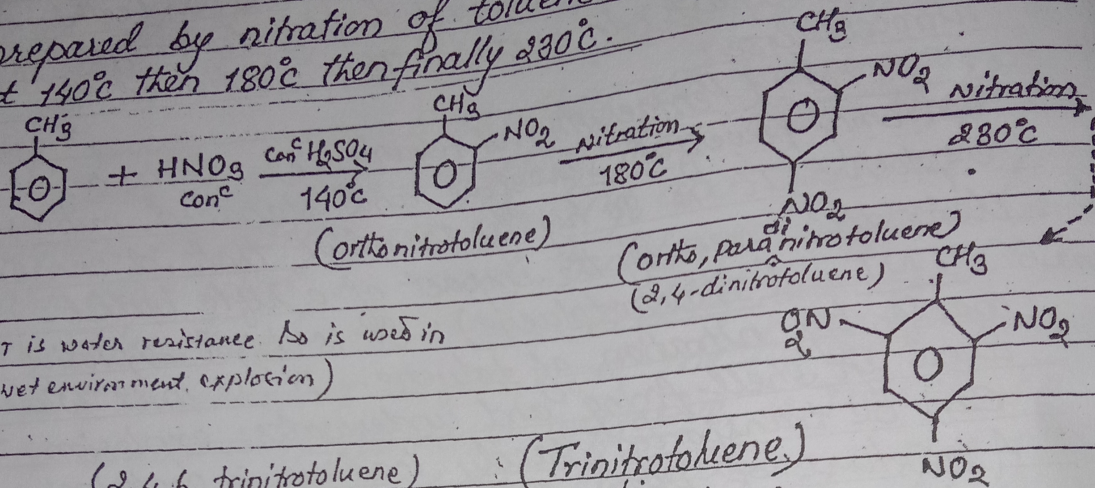
PETN is prepared by using canizaro Rn betⁿ formaldehyde & acetaldehyde. (CH_3CHO). (in CH_2OH catalyst)

[TNT is used to demolish (नष्ट करना) and clearing away the large debris in building foundation. (नष्टाकारक सामग्री)]



Preparation of Some Explosives:

[A] Preparation of TNT: It is trinitrotoluene. $\text{CH}_3\text{C}_6\text{H}_2(\text{NO}_2)_3$
It is a pale yellow crystalline solid prepared by nitration of toluene in a special tank at 140°C then 180°C then finally 230°C .



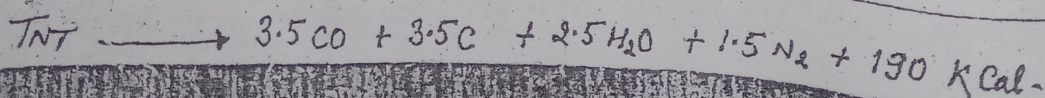
(TNT is water resistance. So is used in wet environment, explosion)

The liquid product, highly concentrated TNT is taken out, washed with ammonical solution of Na_2SO_3 and with water, when TNT crystallizes out, crystallized solid TNT is packed in a sealed bag. Upon detonation it explodes violently.

Application / uses of TNT:

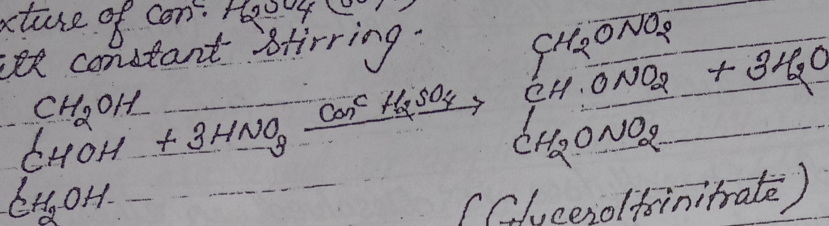
1) It is widely used in shell firing and under water explosions. These are well suited for loading in container because of its low melting point 81°C . Melted TNT is used as carrier for RDX.

2) It is very important for military use because (a) it is safe explosive in manufacture, transportation & storage (b) It is non hygroscopic but explodes violently (c) It does not react with metals. TNT is used to make other binary explosives.



6] Preparation of TNG (or GTN) (Glyceroltrinitrate) (Trinitroglycerine)

It is prepared by adding glycerol with cold mixture of $\text{conc. H}_2\text{SO}_4$ (60%) & conc. HNO_3 (40%) at 10°C with constant stirring.



(Glycerol)

(Glyceroltrinitrate)

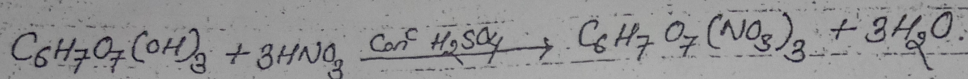
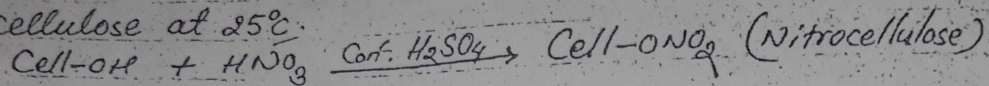
After nitration, the mixture is run into a tank, when nitroglycerine rise to top while excess acid run from lower layer. The nitroglycerine is separated and washed first with water then with dil. Na_2CO_3 solution (2%) to remove traces of acids completely. Then it is converted into different desired types of dynamites in specific inert materials.

Application/uses of TNG:

- 1) It is used to make dynamites and in propellants.
- 2) It is also used as a military propellant for use in guns and rifles.
- 3) Dynamites and similar explosives are widely used for civil engineering tasks such as building construction, railway tunnels, hydroelectric tunnels and cuttings. Submarine blastings, deepwell shooting (drilling) breaking stones from stone mines (ie quarrying stone) (खानिवाट ढुङा निकाल्न).

c) Nitrocellulose (Gun cotton) (Cellulose nitrate):
It can be prepared by nitration of

cellulose at 25°C .



So formed nitrocellulose is dissolved in ether & alcohol. Excess solvent is then evaporated to get jelly like solid. The product is treated with traces of acid and diphenylamine, finally the product is pressed into the cylindrical rod for use or store. It is also called smoke less powder because it produce CO_2 , CO , N_2 water vapour and almost no smoke.

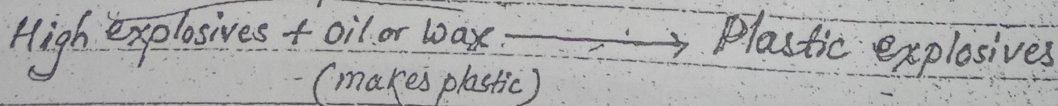
Application/uses of Nitrocellulose:

- 1) It is used in torpedoes (cigar shaped self propelled under water missiles) and submarine mines.
- 2) It is used as propellents in heavy guns & rifles.
- 3) It is also used as lacquer, in flash paper, leather finishing, as printing ink, book binding cloths, ping-pong balls etc.

Plastic Explosives:

Plastic explosives are the combination of explosives which are in plastic (fibre) state and can be hand moulded or press-loaded and made into various shapes without any serious risk.

Preparation: A simple combination to get plastic explosive is a high explosive (giving destructive powder) mixed with wax or oil for making less sensitive as well as more plastic. i.e.



Such material may be moulded into a sheet or a putty like mass. Generally plastic explosives (contains a high explosive like PETN (Pentacrythritol tetranitrate)). These sheets of plastic explosives are cut into the desired shapes and thus can easily be fixed to any metal parts by an adhesive. Special caps are used to start explosion.

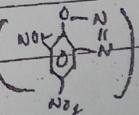
Application / Uses of Plastic explosives:

① These plastic explosives are used or applied in military & industrial purposes so they are available in flexible - sheet explosive also.

② The plastic explosives attached to a piece of metal is used to shape the metal to required shapes that are not achievable by other methods (It is recent method of shaping of metals).

Q: Mention the importance of primary and low explosives.

Regula ⇒ The primary explosives, the detonators, being very sensitive explosives, they are very popular in military uses. Specially lead azide (PbN_6) which is very cheap and has excellent initiating action, are stable in storage also, so they are perfect in military purpose. Primary explosive Mercury fulminate $Hg(CNO)_2$ is more sensitive for initiating but it is more toxic too hence these are ^{not} used in normal public places. Primary explosive tetracene is used as perfect detonator but not used by military as it produce high heat of explosion and large volume of gases. It is low initiating explosive used in mines and ores. Another primary explosive DDNP (Diazodinitrophenol)

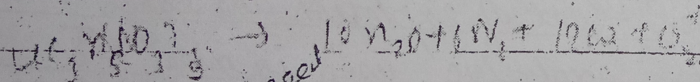
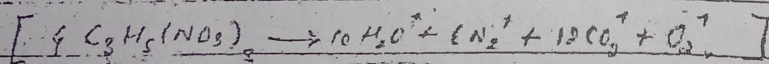


being extremely sensitive used for initiating or detonating very low sensitive high explosives which are used in commercial blasting.

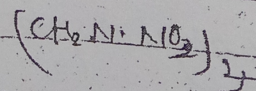
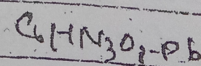
Low explosives are also known as propellants. They do not explode but just burn and emit huge volume of gases so used as propellants or used to launch the objects like rockets, missiles etc. The large volume of gas accounts for its explosive effect. The low explosive specially (gun powder) are excellent in their action, are cheap for blasting down coal into required (shape) size carefully. These are used in practice bombs, fireworks to display colourful light, saluting charges, time in delay fuses etc.

Dynamite:

Dynamites are the nitroglycerine (NG) containing explosives, as main ingredient. The main component of dynamite, nitroglycerine, is an oily liquid which is detonated by pressure or shock spontaneously above 50°C . The amount of inert adsorbent such as kieselguhr, wood pulp, starch meal, saw dust etc to be added to the dynamite varies with its relative strength. Dynamite can break rocks into usable size fragments and also pulverise the fragments. The explosion of nitroglycerine in dynamite is so sudden which would shatter the butt of the rifle before the bullet had time to move so inert adsorbent is essential.



starch meal
saw dust



CM

Amila P. B. P.

Differences between high and plastic explosives.

High explosives

1. These are the real marvellous explosives which mainly contains nitro compounds.

2. These are of fixed shape, can not be moulded, pressloaded into any shape.

3. Though they are insensitive these are quite risky and difficult to transport due to their shape & str.

4. They explode with huge violence producing huge energy with the help of detonators which are primary & sensitive explosives.

5. These are mainly used in engineering, industrial and military purpose.

Plastic explosives

1. These are the combination of explosives, which consists of a high explosive like PETN, RDX etc with oil or wax.

2. These are plastic or fibre like in state, which can be moulded & pressloaded into any reqd shape. They can easily be fixed with other objects using adhesives.

3. Being plastic like flexible 2 can be cut into any shape & size they can be transported easily. These are not risky as high explosives.

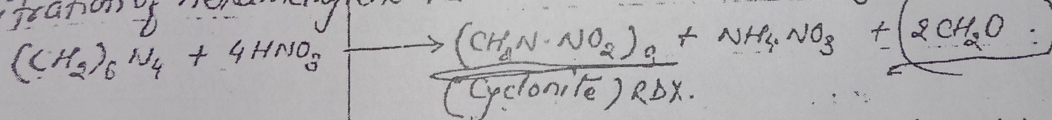
4. These are also the perfect explosives which need special caps to trigger the explosion.

5. These are mainly used in metal industries to give desired shape to metal parts as they can be fixed by using adhesive with metal parts.

RDX: (Research and development explosives):

It is prepared by

nitration of hexamethylene tetramine with con. HNO_3 .



RDX is a white crystalline, water insoluble compound and is highly sensitive to impact and is therefore used in practice in combination with TNT. It is a prominent military and industrial explosive. It is used in torpedo warheads, bombs and shells.

Properties of TNT: It is pale yellow solid, non-hygroscopic. It is toxic chemical. On skin contact, cause skin irritation making skin yellow orange in colour. Long exposure to TNT weakens the liver functioning and causing anaemia (रक्तहीनता) sterility in man. Breathing TNT is harmful to immune system. It is carcinogenic (क्यान्सर जनक). Oral intake produce red coloured urine.

Properties of GTN: It is colourless, very slightly volatile, odourless to sweet aromatic. GTN has high Freezing point 13°C . Frozen GTN is less sensitive. It may explode above 15°C . It is toxic on oral intake, inhalation and dermal contact. Alcohol enhance the effect of GTN.

Properties of Nitrocellulose: It is non toxic but highly inflammable. It is referred as explosive only when nitrogen content is more than 12.6%. It is pulpy cotton like solid, when dry. It is clear liquid to semisolid when dissolve in alcohol. It is soluble in ether, acetone and alcohol.

Properties of Plastic explosive: These are the soft explosives which can be moulded into convenient shapes. They can easily be fixed with any metal parts by an adhesive. Special caps are needed to trigger the explosion in plastic explosives.

LUBRICANTS & PAINTS

Any substance that introduced between two moving/sliding surfaces to reduce the frictional resistance between them is known as lubricant. The main purpose of a lubricant is to keep the sliding/moving surfaces apart, so that frictional resistance and consequent wear and tear (destruction due to use) of material is minimized.

The process of reducing frictional resistance between moving/sliding surface, by the introduction of lubricant in between them, is called lubrication.

Functions of Lubricants

- 1) It reduces frictional resistance and protects moving surface against wear and tear because the direct contact between the rubbing surfaces is avoided.
- 2) It reduces loss of energy in the form of heat, that is generated due to rubbing of surfaces. Thus a lubricant acts as coolant. (cooling agent)
- 3) Since lubricant reduces waste of energy, it enhanced the efficiency of the machine.
- 4) It reduces expansion of metal by local frictional heat production.
- 5) It provides protection against corrosion.
- 6) It also avoids seizure of moving surfaces, since the use of lubricant minimizes the liberation of frictional heat. (seizure = welding of two surfaces due to heat)
- 7) It reduces running and maintenance cost of the machine.
- 8) It also, sometimes acts as seal (eg. lubricant used between piston and cylinder wall of an internal combustion engine acts as seal thereby preventing also the leakage of gases under high pressure from the cylinder).

Classification of Lubricants:

On the basis of physical states, lubricants are classified into following

- 1) Liquid lubricants (Lubricating oils) (Lube oils)
- 2) Semisolid lubricants (Greases)
- 3) Solid lubricants

[1] Liquid Lubricants (Lubricating oils):

(To stand up to use)
Lubricating oil reduces friction and wear between two moving/sliding metallic surfaces by providing a continuous fluid film in between them. They acts as cooling agents, sealing agents & corrosion preventers. A good lubricating oil must have high boiling point, low freezing point, sufficient viscosity for particular condition, high oxidation resistance, heat stability, non corrosive property, stability to decomposition at the operating temperature.

Types of Lubricating Oils

[a] Animal & vegetable oil:

Before the development of petroleum industries animal and vegetable oils were in common use as lubricating oils. They have very good Oiliness (A property by virtue of which the oil sticks to the surface of machine parts even under high temperature and heavy loads). However they are costly, oxidises easily into gummy and acidic product and get thickened on coming in contact with air, They can be hydrolysed when come in contact with moist air, these animal and vegetable oils are rarely used as such in these days. They are used as blending agents (mixing agents) with other lubricating oils.

[egs lard oil, whale oil, tallow oil etc)
(Pig fat oil)]

9] Mineral or Petroleum Oils:

These are obtained from the distillation of petroleum. The length of the hydrocarbon chain in petroleum oils varies from 12 to 50 carbon atoms, the shorter the chain, oil have lower viscosity than the longer chain hydrocarbons. These are most widely used lubricants because they are cheap, well available, quite stable under service condition. Though they have poor oiliness as compared to animal and veg. oils, oiliness can be increased by the addition of high mol. wt. compounds like oleic acid, stearic acid etc.

[c] Blended Oils: (Compound oils)

No any single oil serve as the most satisfactory lubricant for many modern machineries. So the oil formed by adding specific additives in the petroleum oil called blended oil which gives desired lubricating property required for particular machineries. Shortly the blended oils are the improved petroleum oils by some specific additives like coconut oil, castor oil, fatty acids (palmitic acid, stearic acid, oleic acid etc) used as additives in petroleum oil for carriers lubricants, fatty ester, acids, organic compounds containing sulphur, chlorine, organic phosphorous are used as additives in high pressure lubricants.

[d] Synthetic Oils:

Synthetic oils are the lubricating oils for extreme condition of temperature and pressure. They can be applied in drastic conditions in temperature range of -50°C to 250°C . These synthetic oil lubricant possess low freezing point, high viscosity and non-inflammable petroleum based lubricants which can be used under abnormal conditions like extremely high temp., chemically reactive

(eg) Dibasic acid esters, polyglycol ethers, fluor- and chlorohydrocarbons, phosphates, silicones & silicate esters etc are the examples of synthetic lubricating oils.

atmosphere with the application of specific additives are synthetic lubricating oils. Synthetic lubricating oils should have high thermal stability at high operating temperature, high viscosity, chemical stability etc.

(eg) Fluorocarbons, Silicones, Polymerized hydrocarbons like polyethylene, Polypropylene, organic amines & amides)

[22] Semi Solid Lubricants or Greases:

Greases are the lubricants having higher frictional resistance than oils. So these are used in much heavy work load but slow speeds machines and other tools. They need not require much care or attention like lubricating oils. Greases are used ① in situations where oil can not remain in place due to high load, low speed, sudden jerk etc like in axle boxes. ② in bearings and gears that work at high temperature. ③ in situation where bearing needs to be sealed against the entry of dust, dirt, moisture etc. ④ in situation where dripping or spurring of oil is undesirable.

— Greases are prepared by saponification of fat with alkali (NaOH , KOH , Ca(OH)_2 etc) followed by adding of hot lubricating oils. The amount of added lubricating oil determines the quality of grease. In grease soap are the getting agents in the added lubricating oil. To improve the heat resistance nature of grease inorganic solid thickening agents like finely divided clay, silica, carbon black etc are added. Examples of greases are:

a) Calcium based grease: In these greases lime Ca(OH)_2 is used, these are cheapest, most common, satisfactory at low temp. below 80°C .

(lubricants of water pumps, tractors etc)

b) Soda based grease: In these sodium soap is used. These are commonly used in ball and bearings, where lubricants get heated due to friction. These are not water resistance. These can not be used in wet condition, these are high temp. greases.

* These are aircraft lubricants, these are superior to other.

- c) Lithium based Grease: In these lithium soap is used. These are water resistance, suitable for low temp. upto 15°C . *
- d) Axle grease: Very cheap resin grease. Lime is used. These are water resistance, suitable for less delicate (heavy) equipments working under high loads at low speed.

[E3] Solid Lubricants:

Lubricating oils and greases can not be used at very high temperature and high load conditions. lubricating film can not be secured by the use of lubricating oils & greases, in such conditions solid lubricants are applied. The two most usual solid lubricants employed are graphite & molybdenum disulphide. If contamination of lubricating oils or greases by dust, dirt particles are unacceptable, if combustible lubricants are not acceptable solid lubricants come in application. Usually some organic substances are mixed with solid lubricants so that they may stick firmly to the metal surface. Solid lubricants are used either in dry powder form or mixed with water or oil. Examples of solid lubricants are:

a) Graphite Solid lubricants:

It is most widely used of all solid lubricants. It is very soapy to touch, non inflammable and not oxidised in air below 375°C . In absence of air it can be use upto very high temperature. Graphite can be used either in powder form or in suspension form in oil or water. If graphite is dispersed in oil it is called oil dag and when dispersed in water it is called aquadag. Graphite is used as lubricant in air compressors, lathes, general machine workshop, foodstuffs industries, railway track joints open gears, chains, cast iron bearings, ic engines etc.

6) Molybdenum disulphide: (MoS_2) They have very low coefficient of friction and are very stable in air upto 400°C . Its fine powder may be sprinkled on surfaces sliding at high velocity. It is also used along with solvents and greases. Other examples of solid lubricants are talc, mica etc.

PAINTS

Paints are the liquid or mastic fluid which on drying form an ^{or transparent} opaque thin dry solid film on the applied or painted or coated surfaces like timber, wood, metals, bricks, buildings, walls etc.

Paints are made of solid ingredients or pigments and organic binders called vehicle liquid.

[Constituents of Paints (Parts of Paints)

- a) Pigments: - are solid ingredients which determines colour of paint.
- b) Drying oil: - are substances used to dissolve pigments (called vehicles)
these are film forming constituent, e.g. linseed oil, castor oil etc. glycerol ester, high fatty acids.
- c) Drier: - are substances added to help in drying of paint.
Pb, Mn, Co complex time binders, need the water
- d) Thinner: - these are the liquids added in the paint to make it thin so that paint can be applied on the surface more easily. eg. alcohol, turpentine oil etc.
- e) Filler: These are the cheap substances added to paint to increase the quality & quantity of paint. eg. Gypsum, barium sulphate etc.
- f) Plasticizer: These are the constituent of the paints to minimize cracking & to give elasticity to the film. eg. Triphenyl phosphate, Triceryl phosphate.

Characteristics (Requisites) of a Good Paints

- 1) It should stick well to the applied surface and able to seal porous surface.
- 2) It should have high covering power.
- 3) It should dry rapidly to give a homogeneous fluid film.
- 4) It should form quite tough, uniform, adherent (sticking) film on applied surface.
- 5) Its film should not get cracked on drying.
- 6) It should protect the painted surface from corrosion and from other environmental effects (weather effects).
- 7) It should form quite stable colour i.e. the colour should not be fade with light & passage of time as well as weather effects.
- 8) It should be easily applicable with brush & spraying devices and should yield smooth, uniform and decorative (attractive) surface.
- 9) It should possess high adhesion capacity to the material over which paint is applied.

Types of Paints :

The major types of Paints are:

1] Varnishes :

These are the homogeneous colloidal dispersion solutions of natural or synthetic resins (pigments) in oil or thinner. These are used as protective as well as decorative coatings of applied surface. It on evaporation or drying gives hard, glossy (shining), ^{transparent,} lustrous and durable film. These are of two types: Oil varnish & spirit varnish.

Uses of varnishes :

- ① For protection of articles against corrosion.
- ② as a brightening coat to the painted surface.
- ③ For improving the appearance of the applied surface.

2] Enamels: Enamels are the pigmented varnishes. They on drying give lustrous, hard and glossy finish.

They dry at room temperature by oxidation or polymerization or baking enamels dry at elevated temperature in presence or absence of oxygen. The properties of enamels vary widely, depending largely on nature of varnish. Enamel consists usually zinc white (ZnO), litharge (PbO) in varnish as binder (vehicle).

3] Lacquers:

These are the colloidal dispersions of cellulose derivatives, resins etc in solvents and diluents. It dries in air mainly by evaporation of solvents yielding a transparent hard and water proof film. Used in interior decoration like painting of wood work furniture, finishing coat to automobile bodies in coating cotton fabrics which are used in prepⁿ of artificial leather.

4] Emulsion Paints:

These are the dispersion of rubber like resins in water which also contains film forming binder (vehicle), pigments etc. They consist stabilizer preservatives, drier etc. Emulsion paints mostly diluted with water.

Emulsion paint coatings are useful in coating porous and wet surfaces. These are less odorous, non-inflammable, quick drying and easier to apply than other paints and lacquers.

5] Special Paints:

There are many types of special paints. Some of them are:

a) Luminescent Paints: They contain luminophor pigments like zinc sulphide (ZnS)^{ins} which fluoresces under UV light, by absorbing UV light and emitting visible colour light. These paints are used in highway traffic lines & signals to make bright etc. Adm. signboards, roadmarks, no. plates of vehicles, watch dials.

b) Heat resistance Paints: These are the paints that withstand temperature even upto redhot. They contain base of metallic powder like Al, Zn, Sn etc. They are water repellants. These paints are used in ovens, furnaces, aircrafts combustion chambers, engine exhaust pipe etc.

c) Cellulose Paints: These are made from nitrocellulose and celluloid. It dries quickly and becomes hard after addition of thinner. These are non-inflammable, glossy, durable but shrinks after drying. for long time These are used in aeroplane & motorcar industries. high cost paint

d) Antifouling Paints: These are used in marine constructions. They specially contains antifouling agents like mercuric oxide, cuprous oxides etc. which retards the fouling of ships, piers (stone or ^{wooden} boat platform for landing ship boat, submarines etc) etc by marine worms and fungi. This paint also helps in protection from corrosion.

e) Distempers: These are water paints. They consists whetting powder base, glue as binder vehicle, colouring pigment and water as solvent or thinner. These are cheaper paints than other paints, enamels and varnishes. They can be applied easily on plaster, cement concrete walls, interior of buildings. They are durable, smooth & pleasing finish to wall so they are very attractive.

(f) Temperature indicating paints: Consists special ingredients which undergoes change at specific temp. They usually consists double salts of Cu, Fe, Cr, Mn, Co, Ni etc. outer coat of luminous materials. Indicates temp. range (450-1450°C) with only 10% error.

(g) Insect repellent paint: Ingredients organic mercury silicates & organochlorine silicates. (More info. Paints)

Besides these special paints there are many more special paints like coal tar paints (used for protecting iron, steel & wooden surfaces and used in underground materials.) Cement paints, Aluminium paints etc.

(MORE) see - Jain & Jain (15th edition)

Applications of Paints

1. Paints are used for the protection of articles against corrosion.
2. Paints are used for giving the finishing coat to automobile bodies.
3. Paints are used for finishing coat on plaster surfaces of interior walls of building, external surfaces of brick, concrete etc.
4. Paints are used for the decoration of woodworks and furnitures.

Methods of Application of Paints

1) Application of Paint in wood consists of following steps:

a) Surface preparation: Wood must be properly seasoned, clean and dry, free from greases, oils and it is made smooth by rubbing with sand paper of appropriate grade.

b) Knottling: It is the process of sealing of the knots that exude resin & destroy the film of paint. which is done as i) Patent knottling (coating aluminium varnish) ii) ordinary knottling (coating red lead, glue with hot water) iii) Coating lime for 14 hrs.

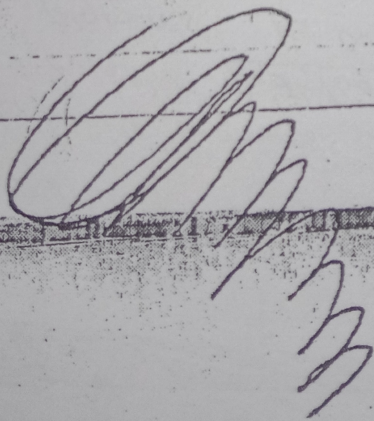
c) Priming: It is the process of filling pores by applying primer like red lead, white lead, litharge, turpentine oil as foundation of coating.

- 1) Stopping: It is the process of filling nails holes, cracks and joints by putty after priming is dry. (Putty is the mixture of chalk & oil).
- 2) Coating: In new wood only one coat of paint is enough. It should not leave patches & brush marks but in old wood, old paint should be removed by NaOH soln & 3 coats are applied.

Paint is used in wood to fill pores, seal the knots (अँरोल), cracks, joints etc and to make it resistant from insects, moisture & acidic gases.

- 2) Application of Paint in iron or steel: It is done to make iron/steel article resistant to corrosion, smooth, decorative in desired colour. For this, rust is removed by scrapping with wire brush, oil & grease are removed by petrol, kerosene, benzene & lime water. The clean surface is primed with red lead. Then two or three coats are applied only after previous coat is dry.

- 3) Paint is applied in galvanised iron as protective layer. ~~But~~ Galvanised iron shows poor adhesion to paint so it is weathered for a year to form zinc oxide that can absorb paint. Before painting a mixture of copperacetate (40 gm/lit.) & 15 gm ^{each of} HCl & CuCl_2 both, $\text{Cu}(\text{NO}_3)_2$ & water in 1 lit of water is used as primer or a mixture of red lead with turpentine can also be used as primer.



(+ note)

Constituents of Paints

1. Pigments:
 - Ⓐ white pigments : Zinc oxide, titanium oxide
 - Ⓑ Red pigments : Red lead, Ferric oxide
 - Ⓒ Blue pigments : Prussian blue
 - Ⓓ Black pigments : Carbon black etc.
2. Drying oil : These are film forming components : egs.
They are also known as hardening oils egs :
Caster oil, linseed oil, tung oil, Soyabin oil etc.
3. Drier : Substances which accelerates the drying of paint film through oxidation, polymerization etc.
egs compounds of Co, Zn, Mn, Pb etc like
resinates, tungstates, linoleates, nepthenates etc.
4. Thinners : liquids added to the paint to reduce the viscosity and also helps to drying of the paints.
egs Turpentine, Spirits, benzene, kerosene, Alcohols etc.
5. Filler : They serve to fill the gaps of the film and hence to form the uniform film of the paints. egs.
Gypsum, barium sulphate, limestone etc.
6. Plasticizer : Which increase the elasticity of paint film.
eg. Vegetable oil, triphenyl phosphate, Triceryl phosphate.
7. Stabilizer : These are the substances which provides chemical inertness to the paint, egs proteins like
Dextrin, Casein etc and Starch.
8. Preservatives : These are added to paint to prevent the growth of fungus and prevent the decomposition of paint protein.
eg. Mercuric chloride.